#3

SEQUENCE LISTING

<110> De Robertis, Edward M.
      Bouwmeester, Tewis


<120> Endoderm, Cardiac and Neural Inducing
   Factors

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<140> US 09/903,171
<141> 2001-07-11

<150> US 60/020,150
<151> 1996-06-20

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        35                  40                  45
Ser Lys Ile Leu Leu Val Asn Thr Lys Gly Leu Asp Glu Pro His Ile
    50                  55                  60
Gly His Gly Asp Phe Gly Leu Val Ala Glu Leu Phe Asp Ser Thr Arg
65                  70                  75                  80
Thr His Thr Asn Arg Lys Glu Pro Asp Met Asn Lys Val Lys Leu Phe
                85                  90                  95
Ser Thr Val Ala His Gly Asn Lys Ser Ala Arg Arg Lys Ala Tyr Asn
            100                 105                 110
Gly Ser Arg Arg Asn Ile Phe Ser Arg Arg Ser Phe Asp Lys Arg Asn
        115                 120                 125
Thr Glu Val Thr Glu Lys Pro Gly Ala Lys Met Phe Trp Asn Asn Phe
    130                 135                 140
Leu Val Lys Met Asn Gly Ala Pro Gln Asn Thr Ser His Gly Ser Lys
145                 150                 155                 160
Ala Gln Glu Ile Met Lys Glu Ala Cys Lys Thr Leu Pro Phe Thr Gln
                165                 170                 175
Asn Ile Val His Glu Asn Cys Asp Arg Met Val Ile Gln Asn Asn Leu
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Cys Phe Gly Lys Cys Ile Ser Leu His Val Pro Asn Gln Gln Asp Arg
         195                    200                    205
Arg Asn Thr Cys Ser His Cys Leu Pro Ser Lys Phe Thr Leu Asn His
     210                    215                    220
Leu Thr Leu Asn Cys Thr Gly Ser Lys Asn Val Val Lys Val Val Met
225                    230                    235                    240
Met Val Glu Glu Cys Thr Cys Glu Ala His Lys Ser Asn Phe His Gln
                 245                    250                    255
Thr Ala Gln Phe Asn Met Asp Thr Ser Thr Thr Leu His His
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aaggacgaga aaggacaaaa acatattcac ttaacagcag aggttacttc agaaaagaaa       180
gaggagcacg taggagcaag attctgctgg tgaatactaa aggtcttgat gaaccccaca       240
ttgggcatgg tgattttcgc ttagtagctg aactatttga ttccaccaga acacatacaa       300
acagaaaaga gccagacatg aacaaagtca agcttttctc aacagttgcc catggaaaca       360
aaagtgcaag aagaaaagct tacaatggtt ctagaaggaa tattttcct cgccgttctt        420
ttgataaaag aaatacagag gttactgaaa agcctggtgc caagatgttc tggaacaatt       480
ttttggttaa aatgaatgga gccccacaga tacaagcca tggcagtaaa gcacaggaaa        540
taatgaaaga agcttgcaaa accttgtttt tcactcagaa tattgtacat gaaaactgtg       600
acaggatggt gatacagaac aatctgtgct ttggtaaatg catctctctc catgttccaa       660
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acctgacgct gaattgtact ggatctaaga atgtagtaaa ggttgtcatg atggtagagg       780
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gaatacccaa atatatgata agataatggg gtcaaaactg ttaaggggta atgtaataat      1140
agggactaag tttgcccagg agcagtgacc cataacaacc aatcagcagg tatgatttac      1200
tggtcacctg tttaaaagca aacatcttat tggttgctat gggttactgc ttctgggcaa      1260
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tgttacaaaa aaaaaaaa                                                     1338
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     <211> 318
     <212> PRT
     <213> Xenopus frazzled

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                   20                    25                    30
Pro Val Arg Ile Pro Met Cys Lys Ser Met Pro Trp Asn Met Thr Lys
           35                    40                    45
Met Pro Asn His Leu His His Ser Thr Gln Ala Asn Ala Ile Leu Ala
       50                    55                    60
Ile Glu Gln Phe Glu Gly Leu Leu Thr Thr Glu Cys Ser Gln Asp Leu
65                    70                    75                    80
Leu Phe Phe Leu Cys Ala Met Tyr Ala Pro Ile Cys Thr Ile Asp Phe
                   85                    90                    95
Gln His Glu Pro Ile Lys Pro Cys Lys Ser Val Cys Glu Arg Ala Arg
              100                   105                   110
Ala Gly Cys Glu Pro Ile Leu Ile Lys Tyr Arg His Thr Trp Pro Glu
          115                   120                   125
Ser Leu Ala Cys Glu Glu Leu Pro Val Tyr Asp Arg Gly Val Cys Ile
       130                   135                   140
Ser Pro Glu Ala Ile Val Thr Val Glu Gln Gly Thr Asp Ser Met Pro
145                   150                   155                   160
Asp Phe Ser Met Asp Ser Asn Asn Gly Asn Cys Gly Ser Gly Arg Glu
                  165                   170                   175
His Cys Lys Cys Lys Pro Met Lys Ala Thr Gln Lys Thr Tyr Leu Lys
              180                   185                   190
Asn Asn Tyr Asn Tyr Val Ile Arg Ala Lys Val Lys Glu Val Lys Val
              195                   200                   205
Lys Cys His Asp Ala Thr Ala Ile Val Glu Val Lys Glu Ile Leu Lys
          210                   215                   220
Ser Ser Leu Val Asn Ile Pro Lys Asp Thr Val Thr Leu Tyr Thr Asn
225                   230                   235                   240
Ser Gly Cys Leu Cys Pro Gln Leu Val Ala Asn Glu Glu Tyr Ile Ile
              245                   250                   255
Met Gly Tyr Glu Asp Lys Glu Arg Thr Arg Leu Leu Leu Val Glu Gly
          260                   265                   270
Ser Leu Ala Glu Lys Trp Arg Asp Arg Leu Ala Lys Lys Val Lys Arg
          275                   280                   285
Trp Asp Gln Lys Leu Arg Arg Pro Arg Lys Ser Lys Asp Pro Val Ala
      290                   295                   300
Pro Ile Pro Asn Lys Asn Ser Asn Ser Arg Gln Ala Arg Ser
305                   310                   315
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ctaattctgc acttttaaat tatctgagta attgttcatt ttgtattgga tgggactaaa     180
gataaactta actccttgct tttgacttgc ccataaacta taaggtgggg tgagttgtag     240
ttgcttttac atgtgcccag attttccctg tattccctgt attccctcta aagtaagcct     300
acacatacag gttgggcaga ataacaatgt ctcgaacaag gaaagtggac tcattactgc     360
tactggccat acctggactg gcgcttctct tattacccaa tgcttactgt gcttcgtgtg     420
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agcctgtgcg gatccccatg tgcaaatcta tgccatggaa catgaccaag atgcccaacc    480
atctccacca cagcactcaa gccaatgcca tcctggcaat tgaacagttt gaaggtttgc    540
tgaccactga atgtagccag gaccttttgt tctttctgtg tgccatgtat gcccccattt    600
gtaccatcga tttccagcat gaaccaatta agccttgcaa gtccgtgtgc gaaagggcca    660
gggccggctg tgagcccatt ctcataaagt accggcacac ttggccagag agcctggcat    720
gtgaagagct gcccgtatat gacagaggag tctgcatctc cccagaggct atcgtcacag    780
tggaacaagg aacagattca atgccagact ctccatgga ttcaaacaat ggaaattgcg    840
gaagcggcag ggagcactgt aaatgcaagc ccatgaaggc aacccaaaag acgtatctca    900
agaataatta caattatgta atcagagcaa aagtgaaaga ggtgaaagtg aaatgccacg    960
acgcaacagc aattgtggaa gtaaaggaga ttctcaagtc ttccctagtg aacattccta   1020
aagacacagt gacactgtac accaactcag ctgcttgtg cccccagctt gttgccaatg   1080
aggaatacat aattatgggc tatgaagaca agagcgtac caggcttcta ctagtggaag   1140
gatccttggc cgaaaaatgg agagatcgtc ttgctaagaa agtcaagcgc tgggatcaaa   1200
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attccagaca agcgcgtagt tagactaacg gaaaggtgta tggaaactct atggactttg   1320
aaactaagat ttgcattgtt ggaagagcaa aaaagaaatt gcactacagc acgttatatt   1380
ctattgttta ctacaagaag ctggtttagt tgattgtagt tctcctttcc ttcttttttt   1440
ttataactat atttgcacgt gttcccaggc aattgtttta ttcaacttcc agtgacagag   1500
cagtgactga atgtctcagc ctaaagaagc tcaattcatt tctgatcaac taatggtgac   1560
aagtgtttga tacttgggga aagtgaacta attgcaatgg taaatcagag aaaagttgac   1620
caatgttgct tttcctgtag atgaacaagt gagagatcac atttaaatga tgatcacttt   1680
ccatttaata ctttcagcag ttttagttag atgacatgta ggatgcacct aaatctaaat   1740
attttatcat aaatgaagag ctggtttaga ctgtatggtc actgttggga aggtaaatgc   1800
ctactttgtc aattctgttt taaaaattgc ctaaataaat attaagtcct aaataaaaaa   1860
aaaaaaaaaa aaaaa                                                     1875
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        <211> 896
        <212> PRT
        <213> Xenopus


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                20                  25                  30
Glu Pro Pro Gly Thr Val Ile Ala Val Leu Ser Gln His Ser Ile Phe
            35                  40                  45
Asn Thr Thr Asp Ile Pro Ala Thr Asn Phe Arg Leu Met Lys Gln Phe
        50                  55                  60
Asn Asn Ser Leu Ile Gly Val Arg Glu Ser Asp Gly Gln Leu Ser Ile
65                  70                  75                  80
Met Glu Arg Ile Asp Arg Glu Gln Ile Cys Arg Gln Ser Leu His Cys
                85                  90                  95
Asn Leu Ala Leu Asp Val Val Ser Phe Ser Lys Gly His Phe Lys Leu
                100                 105                 110
Leu Asn Val Lys Val Glu Val Arg Asp Ile Asn Asp His Ser Pro His
            115                 120                 125
Phe Pro Ser Glu Ile Met His Val Glu Val Ser Glu Ser Ser Ser Val
        130                 135                 140
Gly Thr Arg Ile Pro Leu Glu Ile Ala Ile Asp Glu Asp Val Gly Ser
```

```
          145               150               155               160
Asn Ser Ile Gln Asn Phe Gln Ile Ser Asn Asn Ser His Phe Ser Ile
              165               170               175
Asp Val Leu Thr Arg Ala Asp Gly Val Lys Tyr Ala Asp Leu Val Leu
              180               185               190
Met Arg Glu Leu Asp Arg Glu Ile Gln Pro Thr Tyr Ile Met Glu Leu
              195               200               205
Leu Ala Met Asp Gly Gly Val Pro Ser Leu Ser Gly Thr Ala Val Val
          210               215               220
Asn Ile Arg Val Leu Asp Phe Asn Asp Asn Ser Pro Val Phe Glu Arg
225               230               235               240
Ser Thr Ile Ala Val Asp Leu Val Glu Asp Ala Pro Leu Gly Tyr Leu
              245               250               255
Leu Leu Glu Leu His Ala Thr Asp Asp Asp Glu Gly Val Asn Gly Glu
              260               265               270
Ile Val Tyr Gly Phe Ser Thr Leu Ala Ser Gln Glu Val Arg Gln Leu
              275               280               285
Phe Lys Ile Asn Ser Arg Thr Gly Ser Val Thr Leu Glu Gly Gln Val
          290               295               300
Asp Phe Glu Thr Lys Gln Thr Tyr Glu Phe Glu Val Gln Ala Gln Asp
305               310               315               320
Leu Gly Pro Asn Pro Leu Thr Ala Thr Cys Lys Val Thr Val His Ile
              325               330               335
Leu Asp Val Asn Asp Asn Thr Pro Ala Ile Thr Ile Thr Pro Leu Thr
              340               345               350
Thr Val Asn Ala Gly Val Ala Tyr Ile Pro Glu Thr Ala Thr Lys Glu
              355               360               365
Asn Phe Ile Ala Leu Ile Ser Thr Thr Asp Arg Ala Ser Gly Ser Asn
          370               375               380
Gly Gln Val Arg Cys Thr Leu Tyr Gly His Glu His Phe Lys Leu Gln
385               390               395               400
Gln Ala Tyr Glu Asp Ser Tyr Met Ile Val Thr Thr Ser Thr Leu Asp
              405               410               415
Arg Glu Asn Ile Ala Ala Tyr Ser Leu Thr Val Val Ala Glu Asp Leu
              420               425               430
Gly Phe Pro Ser Leu Lys Thr Lys Lys Tyr Tyr Thr Val Lys Val Ser
              435               440               445
Asp Glu Asn Asp Asn Ala Pro Val Phe Ser Lys Pro Gln Tyr Glu Ala
          450               455               460
Ser Ile Leu Glu Asn Asn Ala Pro Gly Ser Tyr Ile Thr Thr Val Ile
465               470               475               480
Ala Arg Asp Ser Asp Ser Asp Gln Asn Gly Lys Val Asn Tyr Arg Leu
              485               490               495
Val Asp Ala Lys Val Met Gly Gln Ser Leu Thr Thr Phe Val Ser Leu
              500               505               510
Asp Ala Asp Ser Gly Val Leu Arg Ala Val Arg Ser Leu Asp Tyr Glu
              515               520               525
Lys Leu Lys Gln Leu Asp Phe Glu Ile Glu Ala Ala Asp Asn Gly Ile
          530               535               540
Pro Gln Leu Ser Thr Arg Val Gln Leu Asn Leu Arg Ile Val Asp Gln
545               550               555               560
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Asn Asp Asn Cys Pro Val Ile Thr Asn Pro Leu Leu Asn Asn Gly Ser
            565             570             575
Gly Glu Val Leu Leu Pro Ile Ser Ala Pro Gln Asn Tyr Leu Val Phe
            580             585             590
Gln Leu Lys Ala Glu Asp Ser Asp Glu Gly His Asn Ser Gln Leu Phe
            595             600             605
Tyr Thr Ile Leu Arg Asp Pro Ser Arg Leu Phe Ala Ile Asn Lys Glu
            610             615             620
Ser Gly Glu Val Phe Leu Lys Lys Gln Leu Asn Ser Asp His Ser Glu
625             630             635             640
Asp Leu Ser Ile Val Val Ala Val Tyr Asp Leu Gly Arg Pro Ser Leu
            645             650             655
Ser Thr Asn Ala Thr Val Lys Phe Ile Leu Thr Asp Ser Phe Pro Ser
            660             665             670
Asn Val Glu Val Val Ile Leu Gln Pro Ser Ala Glu Glu Gln His Gln
            675             680             685
Ile Asp Met Ser Ile Ile Phe Ile Ala Val Leu Ala Gly Gly Cys Ala
            690             695             700
Leu Leu Leu Leu Ala Ile Phe Phe Val Ala Cys Thr Cys Lys Lys Lys
705             710             715             720
Ala Gly Glu Phe Lys Gln Val Pro Glu Gln His Gly Thr Cys Asn Glu
            725             730             735
Glu Arg Leu Leu Ser Thr Pro Ser Pro Gln Ser Val Ser Ser Ser Leu
            740             745             750
Ser Gln Ser Glu Ser Cys Gln Leu Ser Ile Asn Thr Glu Ser Glu Asn
            755             760             765
Cys Ser Val Ser Ser Asn Gln Glu Gln His Gln Gln Thr Gly Ile Lys
            770             775             780
His Ser Ile Ser Val Pro Ser Tyr His Thr Ser Gly Trp His Leu Asp
785             790             795             800
Asn Cys Ala Met Ser Ile Ser Gly His Ser His Met Gly His Ile Ser
            805             810             815
Thr Lys Val Gln Trp Ala Lys Glu Ile Val Thr Ser Met Thr Val Thr
            820             825             830
Leu Ile Leu Val Glu Asn Gln Lys Arg Arg Ala Leu Ser Ser Gln Cys
            835             840             845
Arg His Lys Pro Val Leu Asn Thr Gln Met Asn Gln Gln Gly Ser Asp
            850             855             860
Met Pro Ile Thr Ile Ser Ala Thr Glu Ser Thr Arg Val Gln Lys Met
865             870             875             880
Gly Thr Ala His Cys Asn Met Lys Arg Ala Ile Asp Cys Leu Thr Leu
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ctggcactgt aattgcagtg ttgtcacaac actccatatt taacactaca gatatacctg      300
caaccaattt ccgtctaatg aagcaattta ataattccct tatcggagtc cgtgagagtg      360
atgggcagct gagcatcatg gagaggattg accgggagca aatctgcagg cagtcccttc      420
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<212> PRT
<213> Mouse FRZB-1

<400> 7

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Met Val Cys Cys Gly Pro Gly Arg Met Leu Leu Gly Trp Ala Gly Leu
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Leu Val Leu Ala Ala Leu Cys Leu Leu Gln Val Pro Gly Ala Gln Ala
            20                  25                  30
Ala Ala Cys Glu Pro Val Arg Ile Pro Leu Cys Lys Ser Leu Pro Trp
        35                  40                  45
Asn Met Thr Lys Met Pro Asn His Leu His His Ser Thr Gln Ala Asn
    50                  55                  60
Ala Ile Leu Ala Met Glu Gln Phe Glu Gly Leu Leu Gly Thr His Cys
65                  70                  75                  80
Ser Pro Asp Leu Leu Phe Phe Leu Cys Ala Met Tyr Ala Pro Ile Cys
                85                  90                  95
Thr Ile Asp Phe Gln His Glu Pro Ile Lys Pro Cys Lys Ser Val Cys
            100                 105                 110
Glu Arg Ala Arg Gln Gly Cys Glu Pro Ile Leu Ile Lys Tyr Arg His
        115                 120                 125
Ser Trp Pro Glu Ser Leu Ala Cys Asp Glu Leu Pro Val Tyr Asp Arg
    130                 135                 140
Gly Val Cys Ile Ser Pro Glu Ala Ile Val Thr Ala Asp Gly Ala Asp
145                 150                 155                 160
Phe Pro Met Asp Ser Ser Thr Gly His Cys Arg Gly Ala Ser Ser Glu
                165                 170                 175
Arg Cys Lys Cys Lys Pro Val Arg Ala Thr Gln Lys Thr Tyr Phe Arg
            180                 185                 190
Asn Asn Tyr Asn Tyr Val Ile Arg Ala Lys Val Lys Glu Val Lys Met
            195                 200                 205
Lys Cys His Asp Val Thr Ala Val Val Glu Val Lys Glu Ile Leu Lys
    210                 215                 220
Ala Ser Leu Val Asn Ile Pro Arg Asp Thr Val Asn Leu Tyr Thr Thr
225                 230                 235                 240
Ser Gly Cys Leu Cys Pro Pro Leu Thr Val Asn Glu Glu Tyr Val Ile
                245                 250                 255
Met Gly Tyr Glu Asp Glu Glu Arg Ser Arg Leu Leu Leu Val Glu Gly
            260                 265                 270
Ser Ile Ala Glu Lys Trp Lys Asp Arg Leu Gly Lys Lys Val Lys Arg
    275                 280                 285
```

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Trp Asp Met Lys Leu Arg His Leu Gly Leu Gly Lys Thr Asp Ala Ser
    290                 295                 300
Asp Ser Thr Gln Asn Gln Lys Ser Gly Arg Asn Ser Asn Pro Arg Pro
305                 310                 315                 320
Ala Arg Ser
```

```
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<212> DNA
<213> Mouse FRZB-1
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